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Specialty Cut Flower Production and Handling

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Floriculture
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Traditional Cut Flowers

- Most cut flowers are imported
  - Columbia, Ecuador, Kenya, Israel, Thailand, and Netherlands
    - Roses, carnations, alstroemeria, gerbera, mums, orchids
- Can ship well
- Popular
- Bulk of arrangements

Specialty Cut Flowers

- What are they?
  - Flowers that do not ship well or have short post-harvest vase-life
  - Dahlia, lisianthus, lilies, peonies, snapdragon, sunflower, and zinnia
- Worth over $450 million annually in the U.S.
  - 90% wholesale (florists, etc.)

Specialty Cut Flower Markets

- Wholesale
- Direct to florists
- U-pick
- Roadside stands
- Farmers markets
- Subscription
  - CSA, restaurants, offices, etc.

Top 10 Specialty Cut Flowers (sales)

- Cut tulips
  - $65,330,000
- Oriental lily
  - $38,287,000
- Gerbera
  - $35,231,000
- Gladioli
  - $25,140,000
- Asiatic lily
  - $25,062,000
- Iris
  - $13,863,000
- Sunflower
  - $13,747,000
- Snapdragon
  - $12,187,000
- Dahlia
  - $10,356,000
- Peony
  - $7,765,000

Association of Specialty Cut Flower Growers Cut Flowers of the Year

http://www.ascfg.org/

- Board of Directors nominate 5 fresh herbaceous, 5 fresh woody and 5 dried / bulb flowers
  - Top performers from ASCFG trials
  - Membership suggestions
- ASCFG membership select top fresh, dried/bulb, and woody cut flowers through electronic voting

Specialty Cut Flower of the Year - Fresh

- 2016 – Snapdragon 'Madame Butterfly'
- 2015 – Celosia ‘Sunday Orange’
- 2014 – Snapdragon Chantilly Series
- 2013 – Stock ‘Katz Cherry Blossom’
- 2012 – Zinnia ‘Queen Red Lime’
- 2011 – Lisianthus ‘Mariachi Carmine’
- 2010 – Dahlia ‘Karma Naomi’
- 2009 – Zinnia ‘Uproar Rose’
- 2008 – Eryngium ‘Blue Glitter’
- 2007 – Hydrangea ‘Limelight’
- 2006 – Echinacea ‘Ruby Star’
- 2005 – Ilex verticillata ‘Winter Red’
- 2004 – Dianthus ‘Amazon Neon Duo’

Picture Source: http://www.ascfg.org/

Specialty Cut Flower of the Year - Dried

- 2011 – Capsicum 'Nippon Taka'
- 2010 – Panicum 'Frosted Explosion'
- 2009 – Achillea 'Coronation Gold'
- 2008 – Sorghum bicolor
- 2007 – Amaranthus 'Hot Biscuits'
- 2006 – Lavandula xintermedia 'Grosso'
- 2005 – Nigella damascena 'Cramers Plum'
- 2004 – Paeonia 'Sarah Bernhardt'
- 2003 – Hydrangea paniculata
- 2002 – Celosia 'Chief' Series
- 2001 – Artemisia 'Silver King'

Picture Source: http://www.ascfg.org/

Specialty Cut Flower of the Year - Bulbs

- 2016 – Tuberose Mexican Single
- 2015 – Ranunculus La Belle Series
- 2014 – Anemone ‘Galilee Blue’
- 2013 – Ranunculus ‘Super Green’
- 2012 – Lily ‘Royal Sunset’

Picture Source: http://www.ascfg.org/

Specialty Cut Flower of the Year - Woody

- 2016 – Hydrangea 'Annabelle‘
- 2015 – Caryopteris ‘Longwood Blue’
- 2014 – Hydrangea Everlasting Series
- 2013 – Symphoricarpos ‘Amethyst’
- 2012 – Vibernum ‘Wentworth’
- 2011 – Physocarpus ‘Coppertina’
- 2010 – Vibernum ‘Snowball’
- 2009 – Hydrangea 'Hamburg'™

Picture Source: http://www.ascfg.org/

Specialty Cut Flower Production

- Site Selection:
  - Well-drained
  - Fertile soils
- Raised Beds
- Field, High Tunnel or Greenhouse

Field Cut Flower Production

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High Tunnel Cut Flower Production

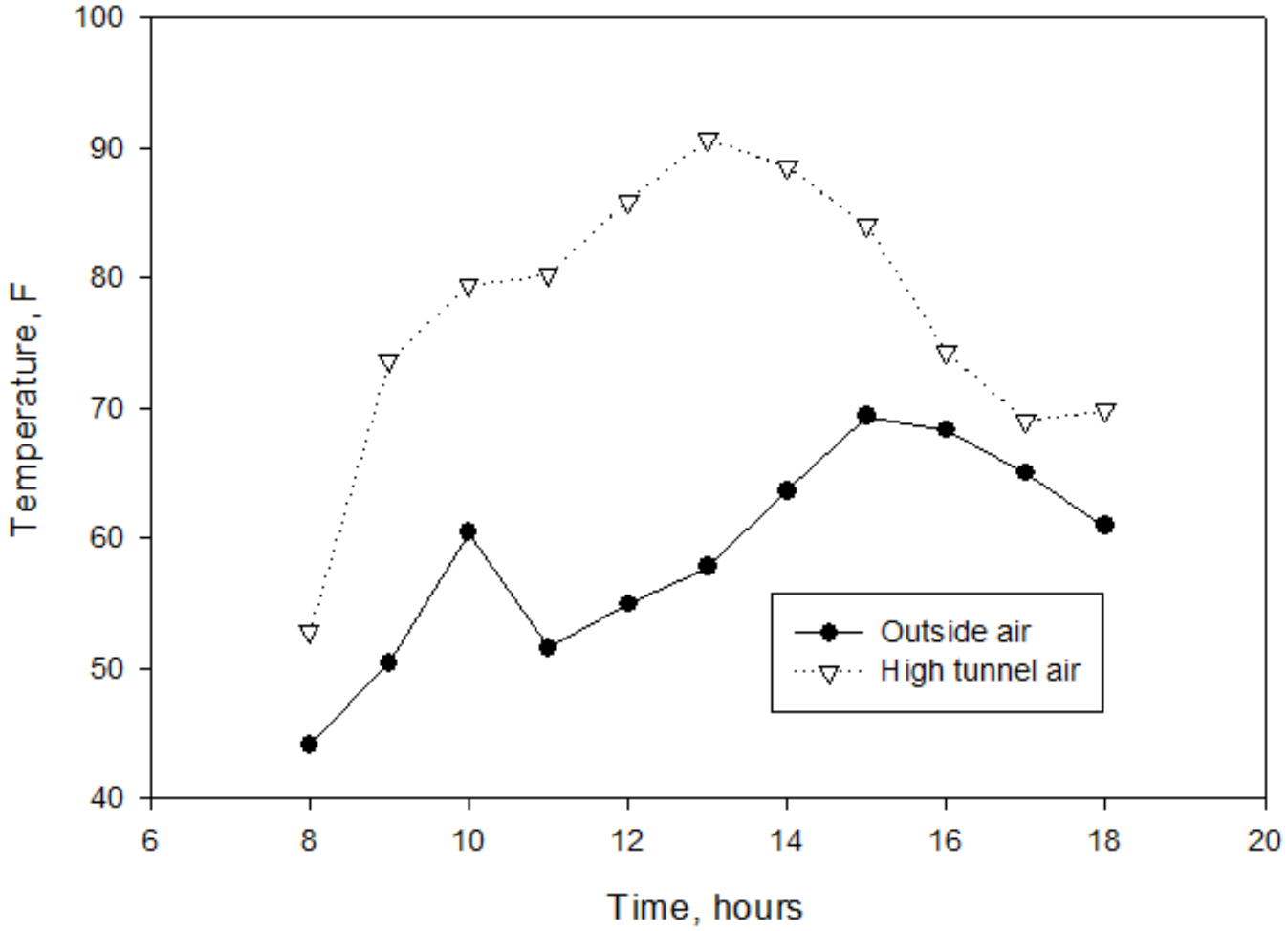
High Tunnels

- High tunnel = unheated single or multi span poly-house or hoop house
  - taller and more uniform temp than a cold frame
- Cost to construct $1 to 3 per square foot
- For overwintering plants typically adds 2 USDA hardiness zones additional protection

High Tunnels

- A temporary structure (single or multi-span) made from a pipe or other durable material framework that is covered in a single layer of greenhouse- grade 4 to 6 millimeter plastic and has no electrical or heating systems.
  - Low set up cost
  - Possibility for fast return on investment

Air temperature inside and outside a high tunnel on a sunny day on April 26, in Ithaca, NY.



Ventilation is absolutely necessary during the day, even when outside air temperatures are not extreme

Chris Wien, Cornell University

High Tunnel Cut Flower Production

- Provides season extension
  - Early spring and fall extension (4 to 6 weeks)
- Protects crops from wind, rain, and hail
- Usually higher quality stem
  - Increased stem length and caliper, earlier flowering, larger flowers

Preparing the High Tunnel

- Topsoil (fine-silty, mixed, mesic Typic Endoaquoll) contained ≈3.2% organic matter and has a pH of 7.0.
- Raised beds gilled with topsoil and compost (pH 6.6)

Raised Beds production in HT

In ground production in HT

Raised bed Production Outdoors

Cut flower High tunnel Research

- Bellflower
  - 'Campana Deep Blue'
- Bells of Ireland
- Celosia
  - 'Chief'
  - 'Bombay Firosa'
- Dahlia
  - 'Karma Thalia'
- Dianthus
  - 'Amazon Neon'
  - 'Amazon Neon Purple'
- Gomphrena
  - 'Fireworks'
- Lisianthus
  - 'Mariachi'
- Matricaria
  - 'Vegmo Snowball Extra'
- Snapdragon
  - 'Rocket'
  - 'Potomac'
  - 'Potomac Lavender'
- Stock
  - 'Katz'
- Sun Flower
  - 'Sunrich Yellow'
  - 'Premier'
- Zinnia
  - 'Benary Giant'


Zinnia
Snapdragon
Sunflower
Dahlia
Lisianthus
Stock
Dianthus
Celosia

‘Bombay Firosa’ celosia

High Tunnel

Field

‘Chief’ Celosia

‘ABC 3 White’ lisianthus

High Tunnel

Field

‘Katz’ stock

High Tunnel

Field

‘Benary Giant’ zinnia

High Tunnel

Field

‘Premier Lemon’ sunflower

High Tunnel

Field

High Tunnel

Field

High Tunnel

Field

Results

- Bellflower
  - 'Campana Deep Blue'
    - No difference between HT or field
- Bells of Ireland
    - HT yielded 10 more stems per 11 ft^2
    - HT stems were >3.5 in. longer, larger flowers
    - Reduced TTH in HT by 6 days
- Celosia
  - 'Chief Red'
    - HT yielded 14 more stems per 11 ft^2
    - HT stems had 17 % smaller flowers by width
  - 'Bombay Firosa'
    - HT stems were 6 in. longer and had 12% larger stem caliper
- Dahlia
  - 'Karma Thalia Dark Fuchsia'
    - Reduced TTH in HT by 4 days

Results

- Dianthus
  - 'Amazon Neon Cherry'
    - In HT, 185 more stems per 11 ft^2 and 10 day reduction in TTH
  - 'Amazon Neon Purple'
    - Field stems were >3.5 in. longer
    - 7 day reduction in TTH
- Gomphrena
  - 'Fireworks'
    - HT stems were >3.5 in. longer
- Matricaria
  - 'Vegmo Snowball Extra'
    - HT stems were 2.5 inches longer
- Lisianthus
  - 'Mariachi Blue'
    - HT stems ≈6 in longer with 8 % larger flowers by width

Results

- Snapdragon
  - 'Rocket'
    - HT yielded 26 more stems per 11 ft^2
    - HT stems >5 in. longer with 29 % longer inflorescences
  - 'Potomac Lavender'
    - HT stems >4 in. longer with 5 % smaller stem caliper
- Sunflower
  - 'Premier'
    - Reduced TTH in HT by 8 days
  - 'Sunrich Yellow'
    - HT stems had 8% larger flowers by width
- Stock
  - Katz Lavender Blue'
    - HT stems ≈5 in. longer, 32 % larger stem caliper, 21 % longer inflorescences, 24 % larger flowers by width

Results

- Zinnia
  - 'Benary Giant Scarlet'
    - HT yielded 192 more stems per 11 ft^2 (59%)
    - HT stems ≈3.5 in. longer, 13 % larger stem caliper, and 12 % larger flowers by width

Average Stem Length (in.)

	High Tunnel	Field
Bell's of Ireland	27.5	23.8
Campanula	13.5	13.0
Celosia	47.6	40.7
Dianthus	19.5	22.9

	High Tunnel	Field
Gomphrena	17.2	14.5
Lisianthus	22.6	18.0
Matricaria	12.6	15.1
Snapdragon	25.8	24.1

Total Marketable Stems Harvested per 40 ft^2

	High Tunnel	Field
Bell's of Ireland	510	238
Campanula	194	215
Celosia	214	216
Dianthus	811	889

	High Tunnel	Field
Gomphrena	1,240	1,237
Lisianthus	35	27
Matricaria	406	388
Snapdragon	297	194

Greenhouse Cut Flower Production

Greenhouse Cut Flower Production

Oriental Lily Greenhouse Production


CYKLOP
SARAH
&
MICHAEL'S

Planting

- Direct sow or transplant
  - Plugs started in greenhouse/high tunnel
- Spacing
  - Species/cultivar dependent
  - Planted closely to encourage stem elongation

Irrigation

- Sprinkler or hand irrigation

- Drip tape
  - Gets water directly to the roots
  - Avoid getting foliage/flowers wet

Wind Protection

- Wind Breaks
  - Field plantings or structures
  - High Tunnel
  - Greenhouse
- Stem Support
  - Wire or plastic mesh

Pest Control

- Insects
  - Aphids, thrips, Japanese beetle, cut worm, grass hoppers
  - Biological or chemical control
- Diseases
  - Fungal; Powdery Mildew
  - Resistant cultivars

What Was Found:

TOP PESTS:

1. Japanese beetle
2. Caterpillar species
3. Thrips
4. Spider mites

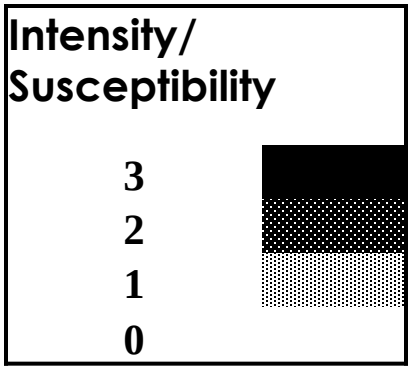
What was Found:

SUSCEPTIBLITY OF FLOWERS:

1. Dahlia
2. Zinnia
3. Snapdragon
4. Sunflower
5. Stock
6. Dianthus
7. Lisianthus
8. Celosia

Insect Intensity

	May	June	July	Aug	Sept
Japanese Beetle					
Caterpillars					
Thrips					
Spider Mites					
Grasshoppers					
Leaf Miners					
Cucumber Beetle					



Plant Susceptibility

	May	June	July	Aug	Sept
Dahlia				NA	NA
Zinnia					NA
Snapdragon					
Sunflower					
Stock					
Dianthus					
Lisianthus					
Celosia					

Japanese Beetles

Caterpillars

Virginia Tiger Moth:
Dahlia

Marsh Caterpillar:
Dahlia

Yellow-Striped Armyworm:
Zinnia, Lisianthus

Thrips

Runners up!

Grasshoppers

Leaf miners

What we found:

FLOWER SUSCEPTIBLITY:

1. Dahlia
2. Zinnia
3. Snapdragon

TOP PESTS:

1. Japanese beetle
2. Caterpillar species
3. Thrips
4. Spider mites

Grower Summary:

TOP FLOWERS GROWN IN MIDWEST:

1. Zinnia
2. Celosia
3. Sunflowers

TOP PESTS:

1. Japanese beetle
2. Thrips
3. Aphids
4. Other

Herbicide Damage

Pre-harvest Factors Effecting Postharvest Life

- Quality
  - Poor quality declines faster
- Nutrition
- Insects and diseases
  - Grounds for rejection by customer
  - Provide entry points for botrytis
  - Increase ethylene production

Pre-harvest Factors

- High light levels promote high carbohydrate levels
  - Maximizes postharvest life
  - Maximum light tolerated for each species without reducing quality
- Lowering temperatures 2 to 10 °F during the last 1 to 3 weeks of the production cycle enhances flower color and quality

When to Harvest?

- Spike-shaped inflorescences (multiple flowers per stem) are harvested when one-fourth to one-half of the florets are open
- Composite family flowers (daisy types) are often harvested when the outer petals are fully developed

Harvesting

- Cut flowers should be harvested in the morning
  - Plants have highest water content
  - Tissue is coolest
  - Cut into water, if possible
- Dry foliage
- Cut location
  - High on the stem
    - best postharvest
    - Less dirt
  - Low on the stem
    - Longest stems
    - More contamination

Harvesting

- Foliage and flowers must be turgid
- But……surfaces must be dry to prevent *Botrytis*

Postharvest Handling of Cut Flowers

Why do we worry about postharvest handling?

- Flowers may look good at harvest but…. Vase life quality can quickly decrease for the consumer

Why do we worry about postharvest handling?

- Allow flowers to reach their full potential:
  - Flowers open completely
  - Flower color develops
  - Buds open / spikes elongates / sprays open
  - Fragrance develops

Long Vase Life

- Allows for postharvest handling, shipping, storage, and outdoor display at markets
- Provide a long period of enjoyment by the consumers and repeat sales!

Key Concepts for Postharvest

- Water
- Carbohydrates
- Ethylene
- Temperature
- Disease prevention

Water

- Keeps flowers alive and turgid
- Effects
  - Prevents wilting
  - Any wilting will decrease vase life
- Sources
  - Held in the stem at time of harvest
  - Provided by the grower in a postharvest solution

Water Uptake

- Vase life declines due to lack of water uptake
- High quality water
  - Promotes water uptake
  - Low salt best: 0.2 – 0.5 dS/m
  - pH 5.0 – 7.0 initially
  - pH 3.5 – 4.0 after treatment
- Knives and stem cutters
  - Sharp and clean
  - Don't crush the stem
- Flowers should not wilt

Stem Blockage

- Microorganisms block xylem (water transport)
  - Bacteria and fungi occur naturally on plants and in tap water
  - Build up in buckets
  - Use a cleaner/soap
  - SANITATION!

Stem Blockage

- Air embolisms (plugs)
  - Form from air drawn into xylem
  - Whenever stems are out of water, recut to remove plug
  - Recut under clean water or recut in the air

Carbohydrates

- Sugars fuel cut flowers
- Effects
  - Open buds
  - Develop/maintain color
- Source
  - Made by the leaves/stored in the stem
  - Provided by the grower in a postharvest solution

Ethylene

- Many flowers are sensitive to ethylene
- Effects:
  - Petal, leaf, flower and bud abscission
  - Bud abortion
  - Shortened vase life

Ethylene

- Sources:
  - Natural aging process
  - Other flowers
  - Engine exhaust, smoke, incomplete combustion from malfunctioning heaters, etc.
  - Rotting leaves, pathogens, fruits, etc.

NEVER STORE/ DISPLAY CUT FLOWERS NEAR FRUIT!

Preventing Ethylene Effects

- Lowering temperature
- Applying anti-ethylene agents
  - Silver thiosulfate (STS) on cuts
    - Effective for longer, but safe disposal is a major issue
  - 1-Methylcyclopropene (MCP) for both cuts and containers
    - Not as long lasting, but very safe to use. Multiple applications can be made

Temperature

- High temperatures in the dark (low light) reduces carbohydrate levels
  - Increase respiration
  - Reduce postharvest life

Temperature

- Cold as possible for the species
  - Close to 32 °F for most species, except tropicals
  - Decrease water loss
  - Decrease carbohydrate loss
  - Decrease ethylene production and reduces ethylene sensitivity

Diseases during Shipping and Storage

- Botrytis
  - Water required for spore germination
  - High humidity for growth
- Pack with dry foliage and flowers
- Pretreat with fungicides

Postharvest practices – What you can do

- Increase water uptake
- Prevent ethylene effects
- Lower temperature
- Prevent diseases
- Use floral preservatives

Floral Preservatives

- Contain one or more:
  - Sugar source
  - Citric or other acid to reduce water pH
  - Anti-microbial agent
  - STS, 1-MCP
  - Plant growth regulators

Floral Preservatives

- Processing/holding solutions
  - Many types available
  - Some specific to the water quality
- Consumer vase solutions
  - Sugar, acidifier, anti-microbial agent

Shipping and storage

- Short as possible!!!!
- Coolers
  - Keep clean
  - One air exchange per hour
  - High humidity (90 – 95%)

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